

# Sodium Reduction in Foods A Public Health Priority?

Presentation to Texas Council on CVD  
and Stroke, December 12, 2008

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## Different Ways to Measure “Salt”

- 6 gm of salt is approximately equal to one teaspoon of salt, which is approximately equal to
- 2300mg of sodium, which is approximately equal to
- 100 mmol of sodium

# Overview

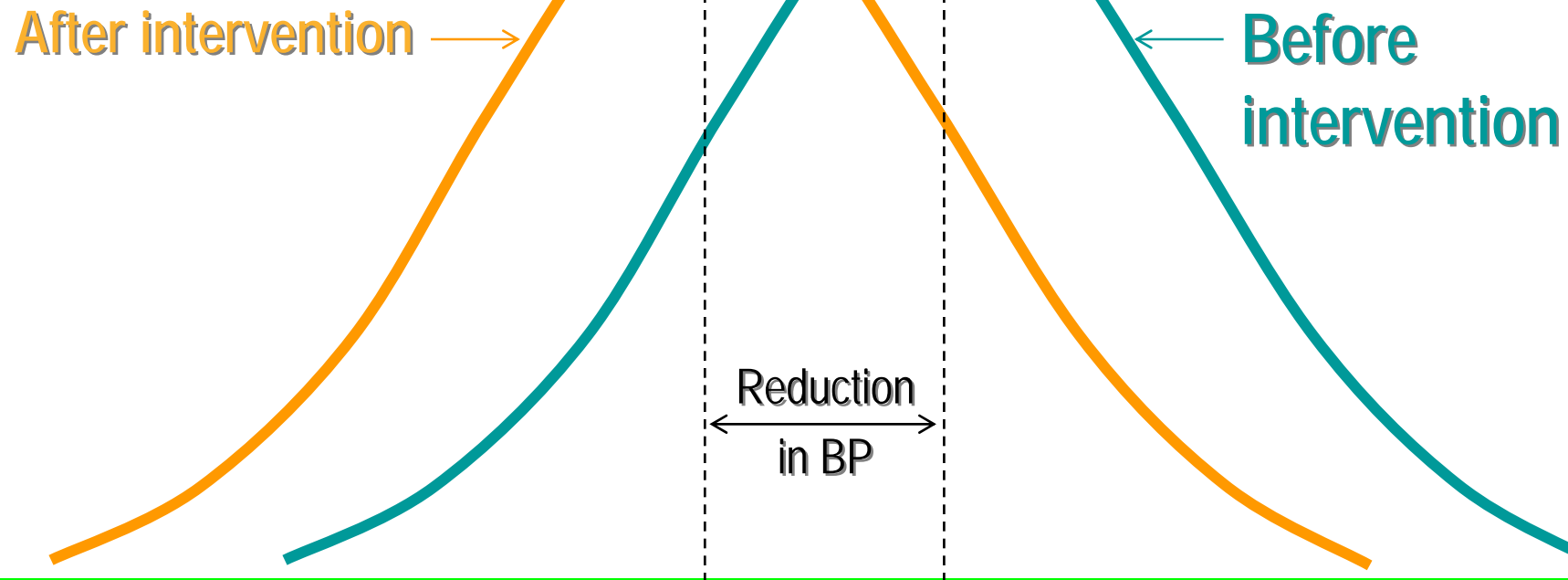
- 60% of adults have elevated blood pressure
- Average intake: 4000 mg (~75% added) → 2300 mg
- Adequate intake: 1500 mg for healthy, 19-50 years
- AMA adopts directives at annual meeting 2006
- FDA has been asked to revoke the "generally recognized as safe" status to a "food additive"
  - a stepwise 50% reduction
  - improve labeling to assist consumers in understanding the amount of sodium
  - social marketing for consumer awareness
- **150,000 fewer deaths a year by decreasing hypertension by 20% in ages 25-55 with a 50% reduction**

## AHA 2006: Dietary approaches to prevent and treat HTN

- In aggregate, available data strongly support population-wide recommendations to lower salt intake.
- To reduce salt intake, consumers should choose foods low in salt and limit the amount of salt added to food.
- However, because >75% of consumed salt comes from processed foods,
  - any meaningful strategy to reduce salt intake must involve the efforts of food manufacturers and restaurants,
  - should progressively reduce the salt added to foods by 50% over the next 10 years.



# Population-based Strategy Effects of Lowering SBP Distributions



Reduction in BP  
mm Hg

% Reduction in Mortality  
Stroke CHD Total

2

-6

-4

-3

**Stamler J. *Hypertension*  
1991;17:1-16-1-20.**

3

-8

-5

-4

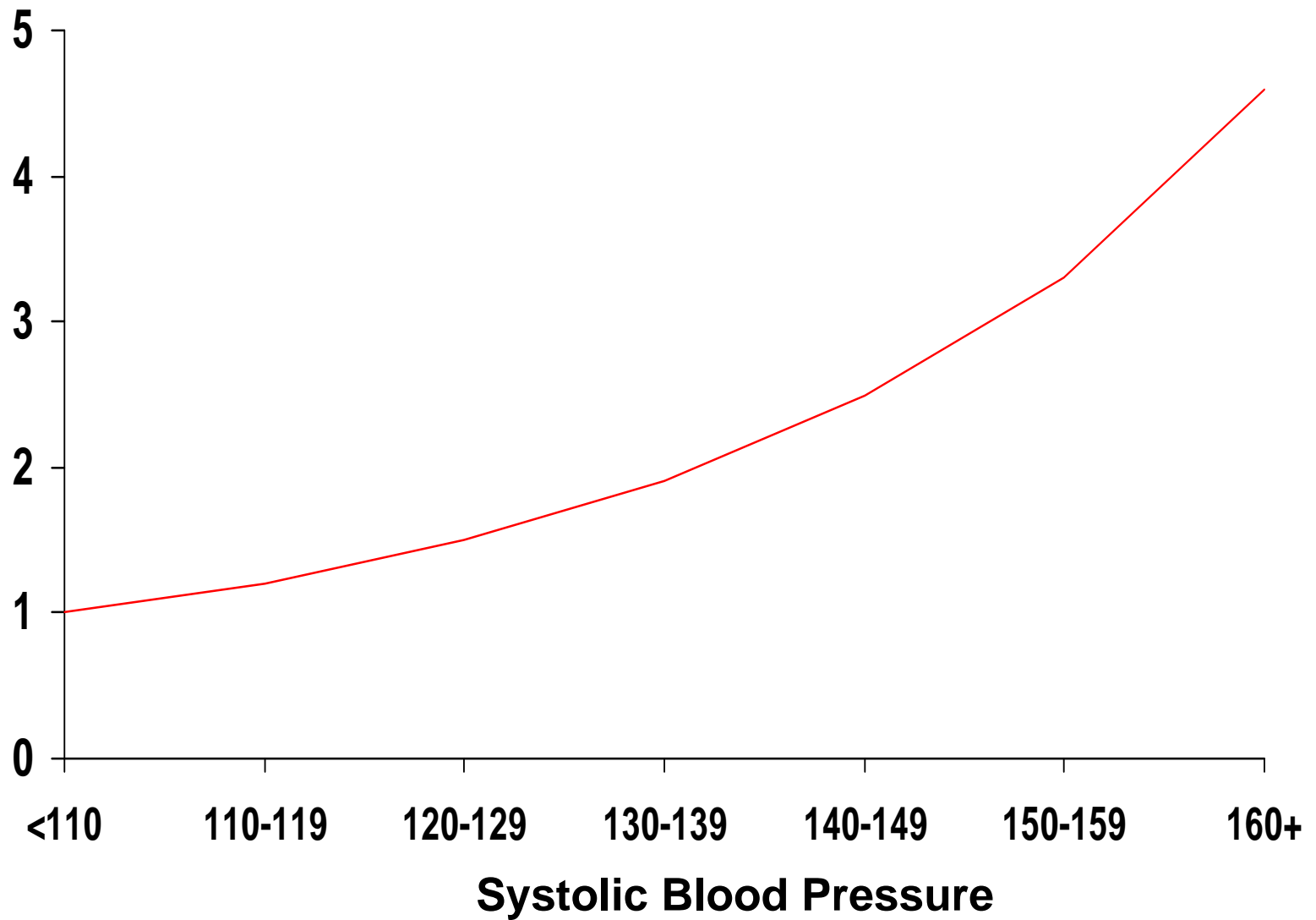
5

-14

-9

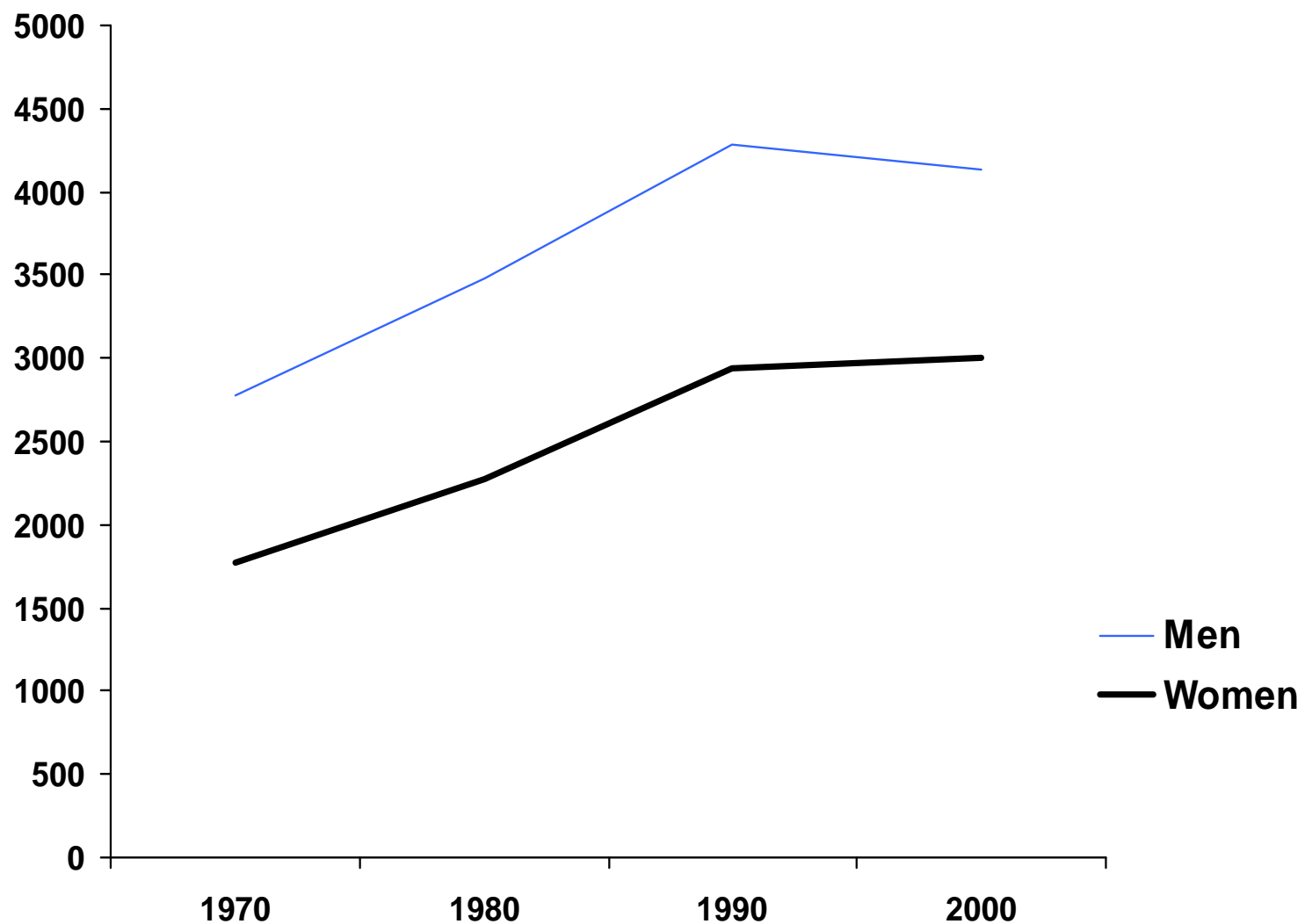
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## Relative Risk of Developing CHD vs. Systolic Blood Pressure



Neaton JD. *Arch Int Med* 1992; 152:56-64.

## Changes in Sodium Intake 1970-2000, U.S.\*



NHANES I

NHANES II

NHANES III

NHANES

cont.

\* Excludes salt added at the table.

## Why Has Sodium Consumption Been Rising?

- Increased use of processed foods
- More eating out in restaurants
- Bigger portion sizes
- Physician counseling largely focused on added salt



## Statement on Sodium from the Initial Primary Prevention Report, 1993

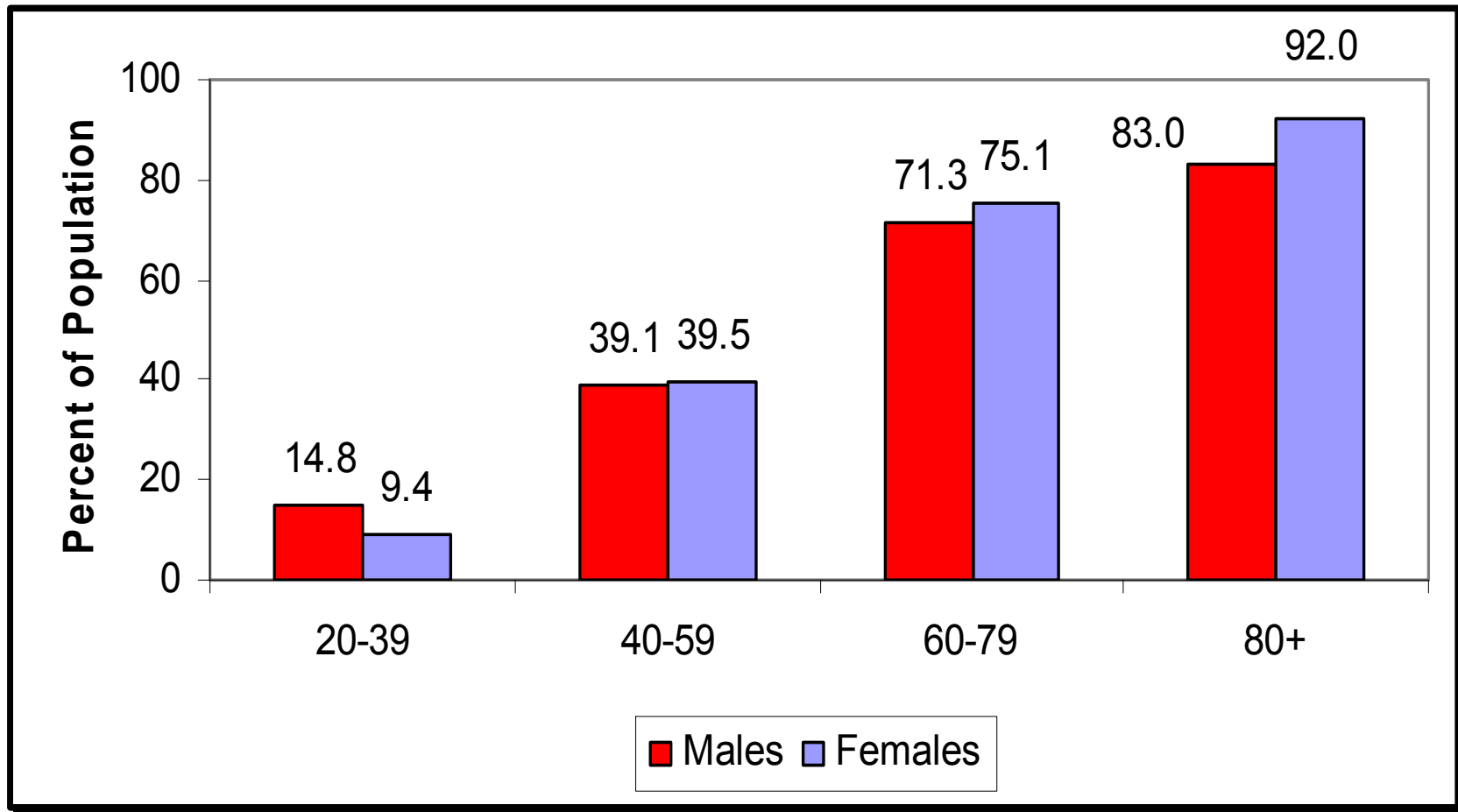
“Given the **ubiquitous** nature of sodium in **processed foods**, the potential for a **reduction** in sodium intake far **exceeds** that which has been shown in **intervention studies** and is easily **achievable** in contemporary society. Thus, changes in food manufacture, as well as public education initiatives, provide a basis for much more substantial reductions in sodium consumption. Given such changes, **a societal goal** of sodium chloride intake for the general population of **no more than 6 grams per day is reasonable and achievable.**”

National High Blood Pressure Education Program Working Group. *Arch Int Med* 1993; 153:186-208.

# Background to the 1993 Report

- The relationship between blood pressure and risk of cardiovascular disease is strong, continuous, and independent, with the risk increasing progressively as blood pressure rises above optimal levels.
- The prevalence of HBP increases dramatically with age.
- One of every two adults over age 60 has HBP.
- HBP increases morbidity and mortality from CHD, stroke, CHF, and end-stage renal disease.

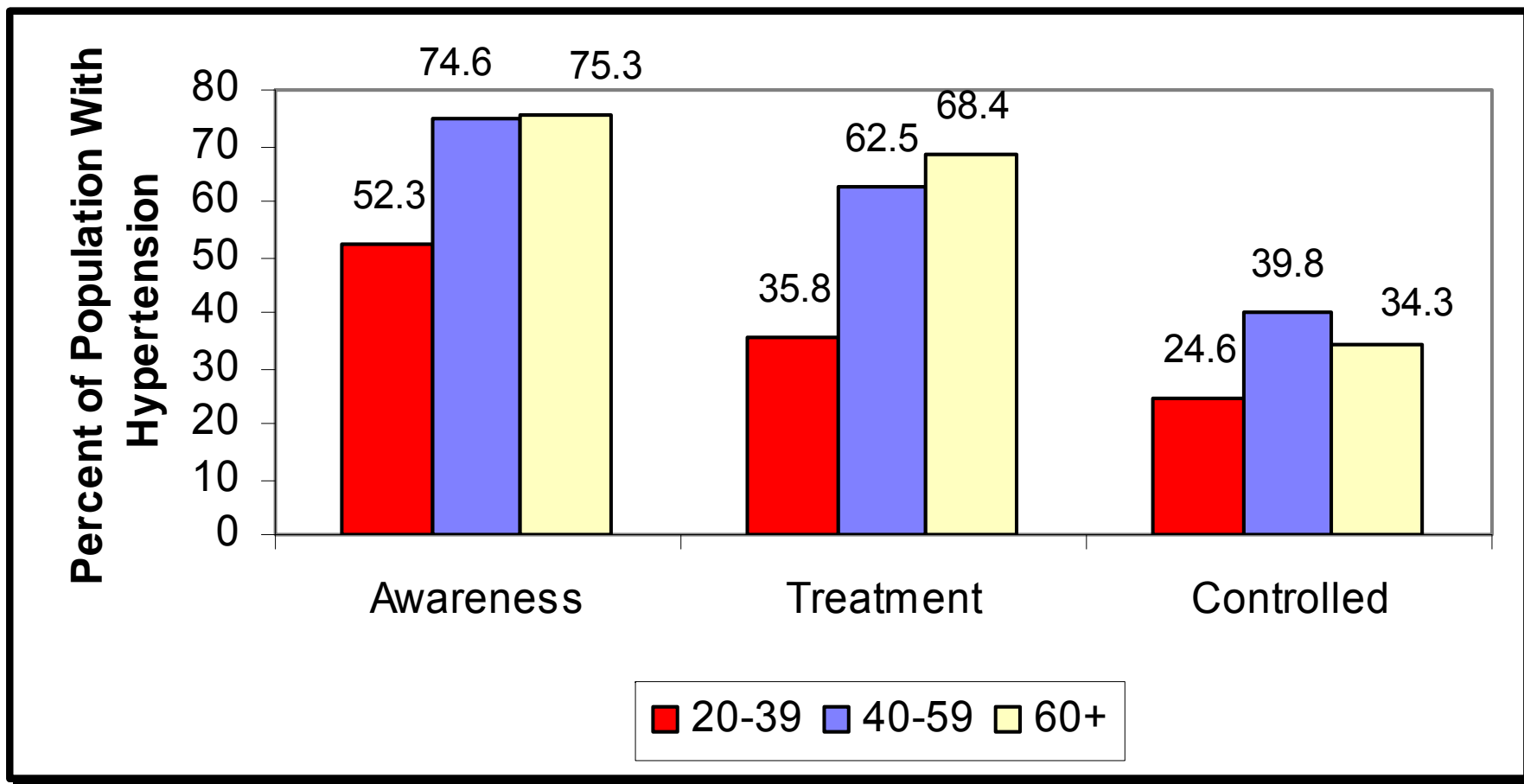
## Prevalence of CVD in adults age 20 and older by age and sex



**(NHANES: 1999-2004). Source: NCHS and NHLBI.**

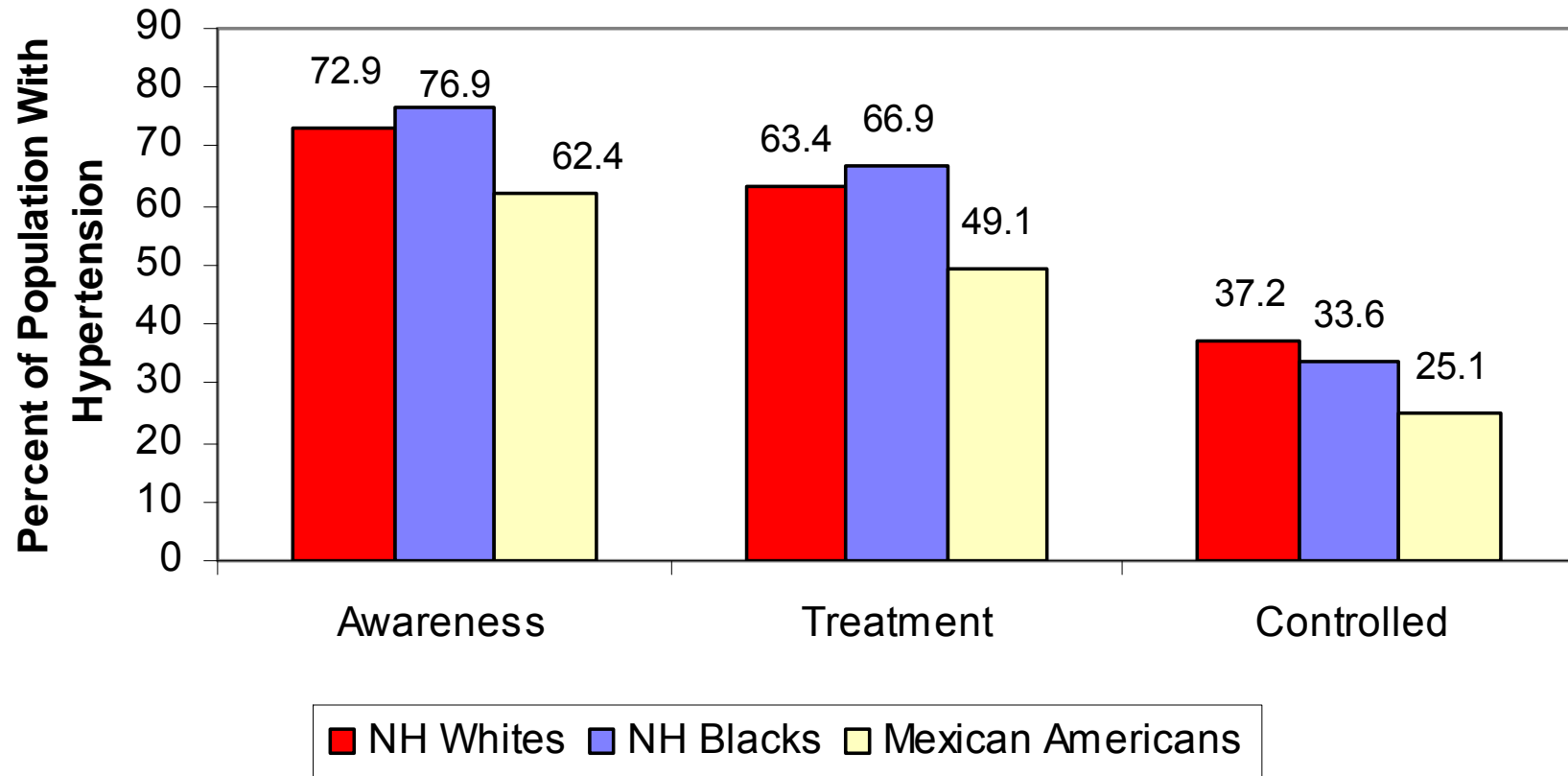
**These data include coronary heart disease, heart failure, stroke and hypertension.**

## Extent of awareness, treatment and control of high blood pressure by age



(NHANES : 1999-2004). Source: NCHS and NHLBI.

## Awareness, Treatment and Control of High Blood Pressure by Race/Ethnicity



**(NHANES: 1999-2004).**

**Source: NCHS and NHLBI.**

## Of the unaware hypertensives...

- 90 % of Unaware have insurance
- 80% have a usual source of care
- 75% had a BP measurement in the last year
- 96% had a BP measurement in the last 4 years
- Mean age 58
- Mean BP 148/83

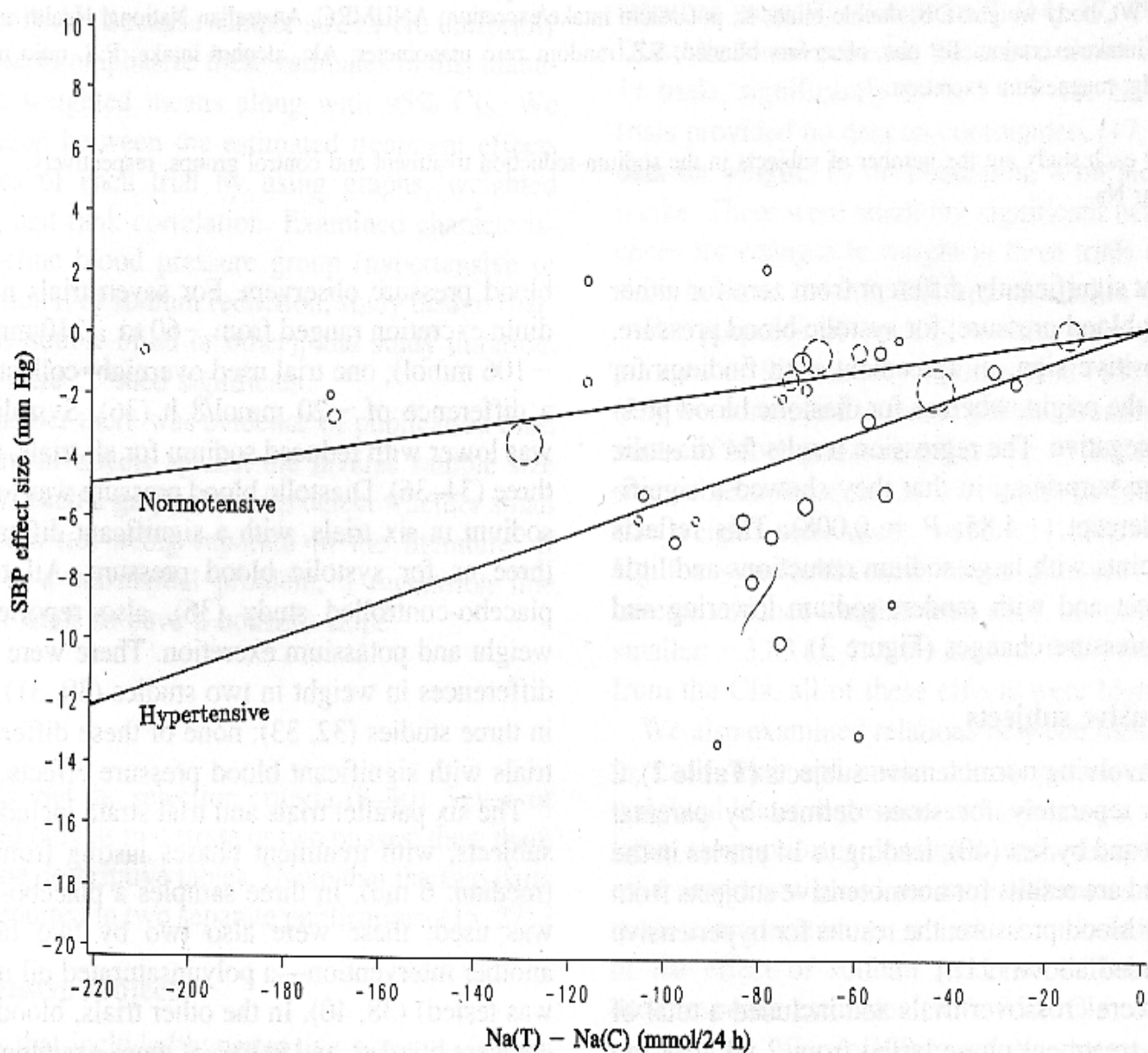
## Sodium Intake in the United States

- Sodium reduction in the food supply is the hypertension prevention strategy most amenable to a public health solution.
- Randomized clinical trials show that  $\text{Na}^+$  reduction results in BP in both hypertensives **and** non-hypertensives.
- High sodium intake is associated with  $\uparrow$  CVD and all-cause mortality, **independent** of effects on BP
- High sodium intake is associated with an increased risk of developing osteoporosis and renal stones

## Other harmful effects of sodium

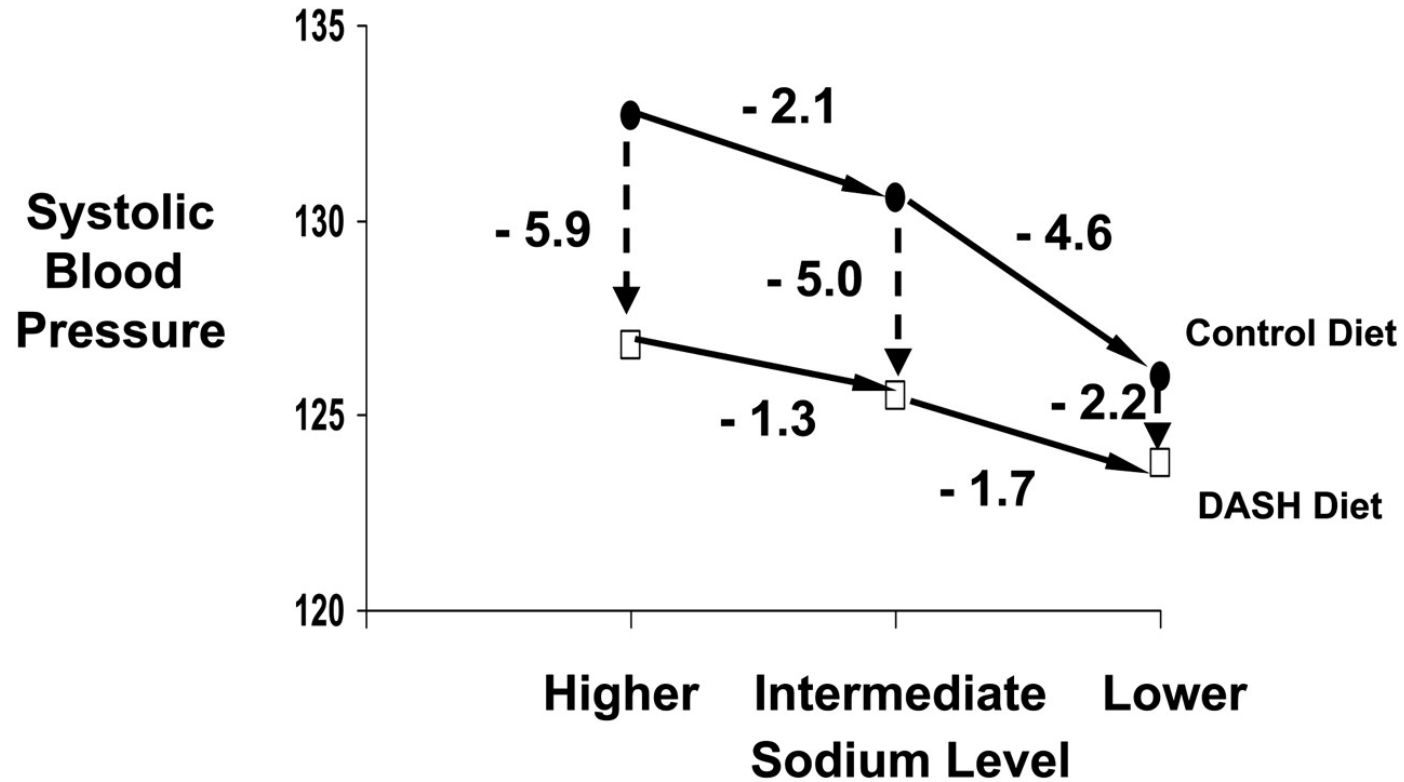
- independent predictor of left ventricular mass
- increased platelet reactivity
- increases caloric consumption by increasing fluid intake
  - increase in sodium consumption since the 1970s has resulted in an estimated increase of 278 kcal/d due to greater consumption of sugar-sweetened beverages
- A lower-salt diet reduces aortic stiffness, independent of its effect on blood pressure, and studies show that salt intake is linked to arterial compliance





**FIGURE 2.** Dose-response analysis: weighted linear regression of systolic blood pressure (SBP) as a function of mean net change in sodium excretion. Lines are forced through the origin. Trials involving hypertensive and normotensive subjects are analyzed separately. T, treatment group; C, control group.

## Mean systolic BP changes in the DASH-Sodium trial



Appel, L. J. et al. Hypertension 2006;47:296-308

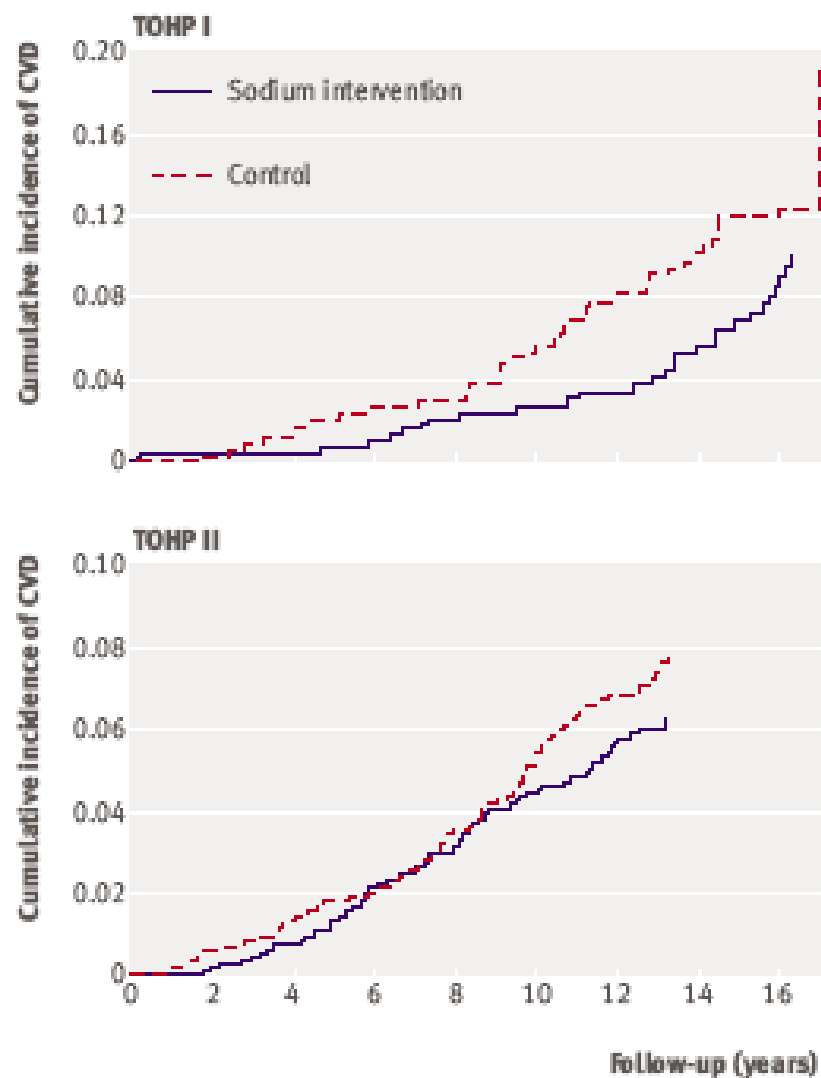


Fig 2 | Cumulative incidence of cardiovascular disease (CVD) by sodium intervention group in TOHP I and II, adjusted for age, sex, and clinic

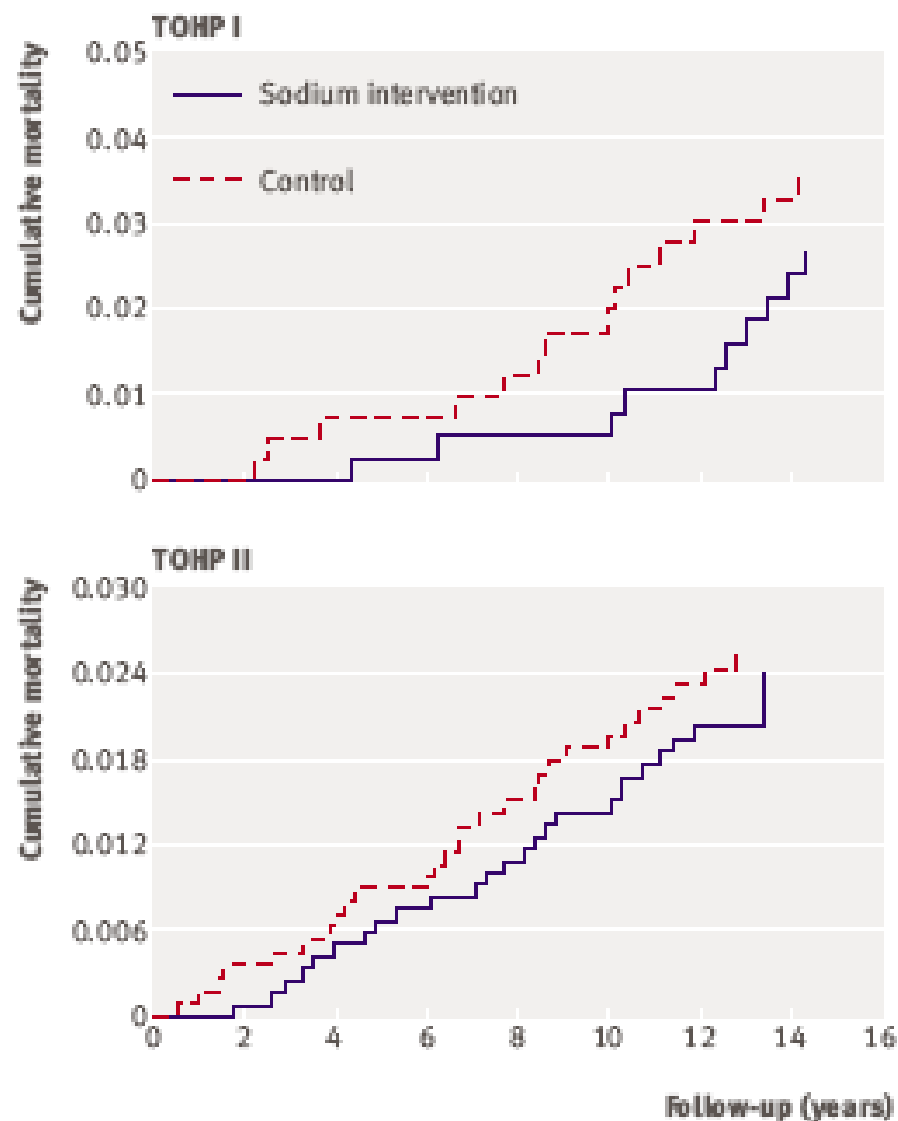


Fig 3 | Total mortality by sodium intervention group in TOHP I and II, adjusted for age, sex, and clinic

## How big a problem is CVD in Texas?

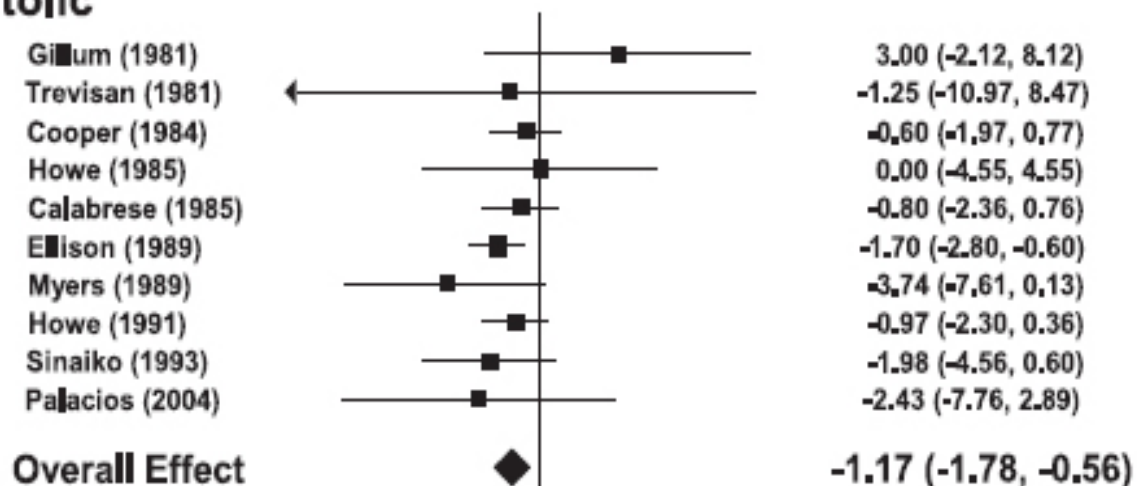
- One third of all Texas deaths are due to:
  - Heart disease: 41,000
  - Stroke: 9,900
- Hospitalizations in Texas for CVD: 244,000
  - 48% in persons younger than 65
  - \$10 billion: 80% due to heart disease, 20% stroke
  - \$ 1 million every hour
- Texas adults (07 BRFSS): had heart attack
  - Men: 4.8%    Women: 3.6%
- Texas adults (07 BRFSS): had a stroke
  - Men: 2.6%    Women: 3.0%

## What can we do about it?

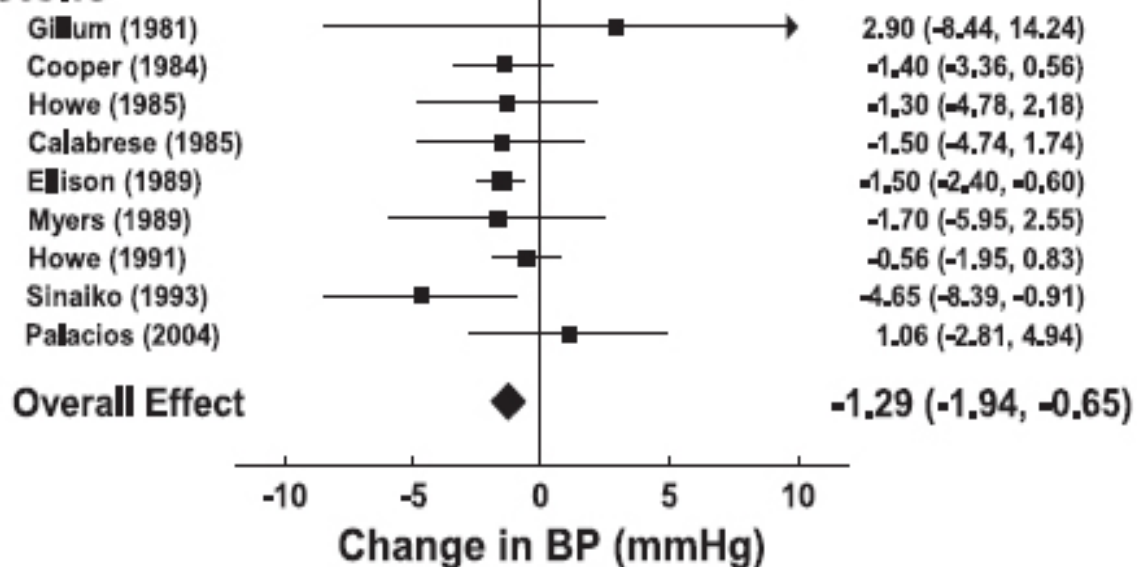
- **Prevent** risk factors that lead to conditions that lead to heart disease (other than salt reduction)
  - Inadequate fruits and vegetables (2007): 74.8%
  - Overweight and obesity (2007): 65.8%
  - Inadequate physical activity (2007): 53.5%
  - Smoking (2007): : 19.3%
- **Detect & manage** conditions leading to heart disease
  - High cholesterol, TX adults (2007) : 38.5%
  - High blood pressure, TX adults, (2007) : 27.8%
    - Poor control, 60+ years: men-36%, **women-54%**
  - Diabetes, TX adults (2007): 10.3%

# Meta-analysis of RCTs of Sodium Reduction in Children

## Systolic



## Diastolic



**Figure 2.** Mean net change in BP and corresponding 95% CI in individual trials included in the meta-analysis. The overall effect represents the pooled estimate of mean net change in BP. The size of the symbol is in proportion to the weight (ie, inverse of the variance of the net change in BP) of the trial.

# Childhood Obesity

- National Diet and Nutrition Survey for young people in Great Britain, a 7-day dietary record was used to evaluate salt and fluid intake in 1688 participants aged 4 to 18 years in 1997
- Salt intake was significantly associated with sugar-sweetened soft drink intake even after adjustment for age, sex, body weight, and physical activity
- Reduction in salt intake of 50% to 3 g/day (1,200 mg sodium) was predicted
  - to reduce sugar-sweetened soft drink intake by 2.3 sugar-sweetened soft drinks per week per child
  - about 5 pounds per year

*Hypertension* Feb, 2008, He et al

# Dietary Guidelines for Americans, 2005

## KEY RECOMMENDATIONS

- Consume less than 2,300 mg (approximately 1 tsp of salt) of sodium per day.
- Choose and prepare foods with little salt. At the same time, consume potassium-rich foods, such as fruits and vegetables.

### Key Recommendations for Specific Population Groups

- *Individuals with hypertension, blacks, and middle-aged and older adults.* Aim to consume no more than 1,500 mg of sodium per day, and meet the potassium recommendation (4,700 mg/day) with food.

69%



**TABLE 15. Range of Sodium Content for Selected Foods**

The ranges of sodium content for selected foods available in the retail market. This table is provided to exemplify the importance of reading the food label to determine the sodium content of food, which can vary by several hundreds of milligrams in similar foods.

Food Group	Serving Size	Range (mg)
Breads, all types	1 oz	95–210
Frozen pizza, plain, cheese	4 oz	450–1200
Frozen vegetables, all types	½ c	2–160
Salad dressing, regular fat, all types	2 Tbsp	110–505
Salsa	2 Tbsp	150–240
Soup (tomato), reconstituted	8 oz	700–1260
Tomato juice	8 oz (~1 c)	340–1040
Potato chips <sup>a</sup>	1 oz (28.4 g)	120–180
Tortilla chips <sup>a</sup>	1 oz (28.4 g)	105–160
Pretzels <sup>a</sup>	1 oz (28.4 g)	290–560

<sup>a</sup> All snack foods are regular flavor, salted.

Source: Agricultural Research Service Nutrient Database for Standard Reference, Release 17 and recent manufacturers label data from retail market surveys. Serving sizes were standardized to be comparable among brands within a food. Pizza and bread slices vary in size and weight across brands.

Note: None of the examples provided were labeled low-sodium products.

# **International Efforts**

## ***England***

**Department of Health and Food standards agency goal 2.4 gm sodium by 2010**

**50 food manufactures have signed on and begun to reduce**

## ***Ireland***

**Pressuring food industry**

## ***New Zealand / Australia***

**Strict labeling**

**Industry pressure to reduce sodium has reduced**

**Sodium in breads, cereals, margarine**

## ***France***

**Goal 20% reduction in 5 years**

## ***Finland***

**National focus since 1970s**

**Sodium decrease from 4700 to 3300**

**Population decrease in blood pressure**

## Sodium Content: UK vs. US

McDonald's McNuggets, French Fries, Big Mac, Sausage and Egg McMuffin: *On average, 46% more sodium in US than UK.*

**Kellogg** (Rice Krispies, Corn Flakes, Special K): *On average 36% more sodium in US than UK.*



**Bacon Double cheeseburger 1.4 gm**

**Side order fries 0.9 gm**

**Chicken strip with fries, gravy, toast 2.5 gm**

**H-E-B**

**Grilled Chicken with Fat Free Italian 1.3 gm!!**

[www.nutritiondata.com](http://www.nutritiondata.com)



# Primary Prevention of Hypertension and CVD via food supply sodium reduction:

- Food reformulation
  - Most sodium is in processed food
    - Individual action is extremely difficult
    - Commercial alternatives exist
    - Food supply interventions are occurring in the world
- 1.3 gm average daily decrease will prevent 5mm/Hg rise in BP with age and save 150,000 lives year
- 5 mm Hg smaller rise in BP from 25 to 55
- 20% reduction in hypertension
- Mortality reductions of 14% for stroke and 9% for CHD

## Sodium Intake in the United States

- Current consumption levels of sodium greatly exceed physiologic need.
- Increasing intake of sodium parallels the obesity epidemic.
- Current NHBPEP recommendation is a daily  $\text{Na}^+$  intake of  $\leq 2400$  mg
  - About 20% of the population meet that standard.
- The 2010 Objective for the Nation is for 65 percent of persons aged 2 and above to consume  $\leq 2400$  mg.
- This objective ***cannot*** be achieved unless food processing and restaurant preparation practices in the United States are changed.

## APHA Press Conference: Effect of Reducing Sodium by 50% in Processed and Restaurant Foods

- A decline of at least 5 mm Hg in mean systolic blood pressure
- A decline of up to 20% in the prevalence of hypertension
- A decline of at least 9% in deaths from CHD
- A decline of at least 14% decline in deaths from stroke
- A decline of at least 7% in mortality from all causes
  - resulting in at least 150,000 lives saved annually

Havas S, Roccella E, and Lenfant C. *Am J Pub Health* 2004; 94:19-22.

## 150,000 Premature Deaths in the U.S. Annually

- How many deaths does this translate into for your community?
- How many additional individuals get non-fatal heart attacks, CHF, strokes, and/or kidney disease?
- Does this create a public health imperative for action?



## State/Local Options

- Do nothing
- Urge FDA/USDA to set sodium limits (2009)
- Urge Congress to hold hearings, pass laws to lower sodium
- Limit sodium in school foods, government cafeterias, prisons, hospitals, government sponsored meetings, TMA-sponsored meetings
- Require warning labels on high-sodium foods (or on supermarket shelves or on placards)
- Require sodium disclosures and/or warnings on *chain-restaurant* foods/meals

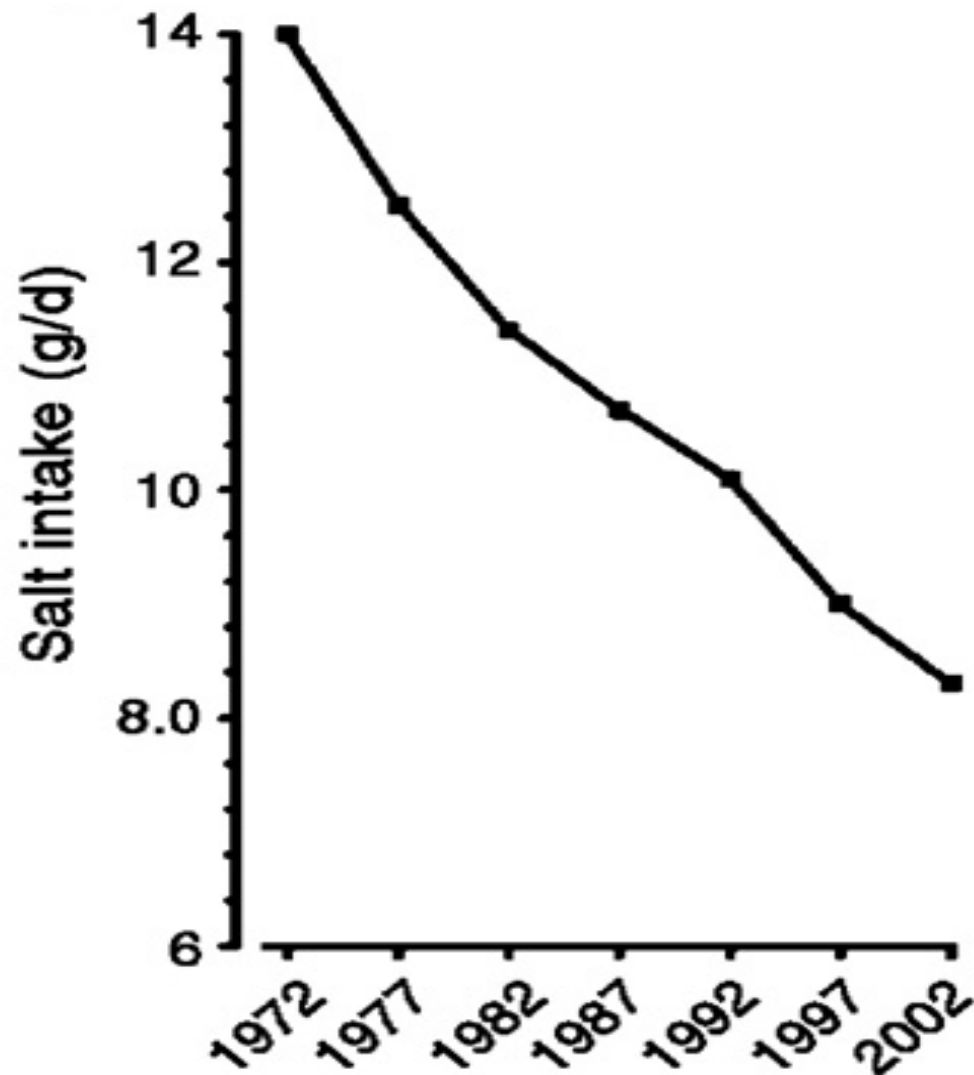
## **UK Industry's Sodium Reductions**

- Breakfast cereals 43% less
- Sliced bread over 30% less
- Pasta sauces over 30% less
- Soups over 25% less
- Sweet biscuits over 45% less
- Savory biscuits over 25% less
- Cakes over 25% less
- Pastries 40% less

# Finland

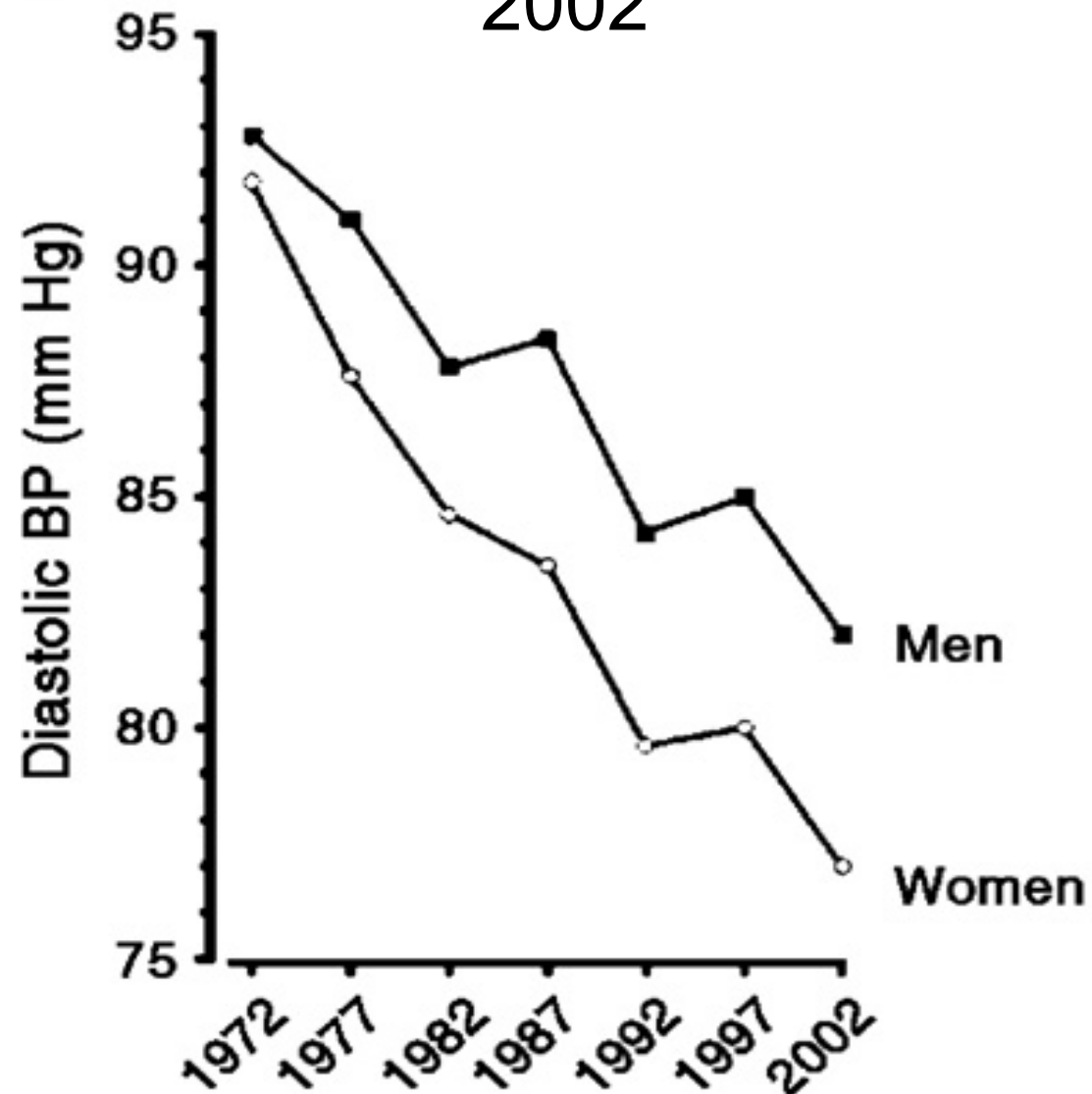
- Government recommendation of 50% reduction in salt
- Media publicity in the 1970s
- Increased use of reduced-sodium salts
- Law requiring “high in salt” notices on major sources of sodium
- 1997: Government/Industry/NGO consensus to reduce salt in foods by *additional* 50%

# Changes in Salt Intake in Finland, 1972-2002



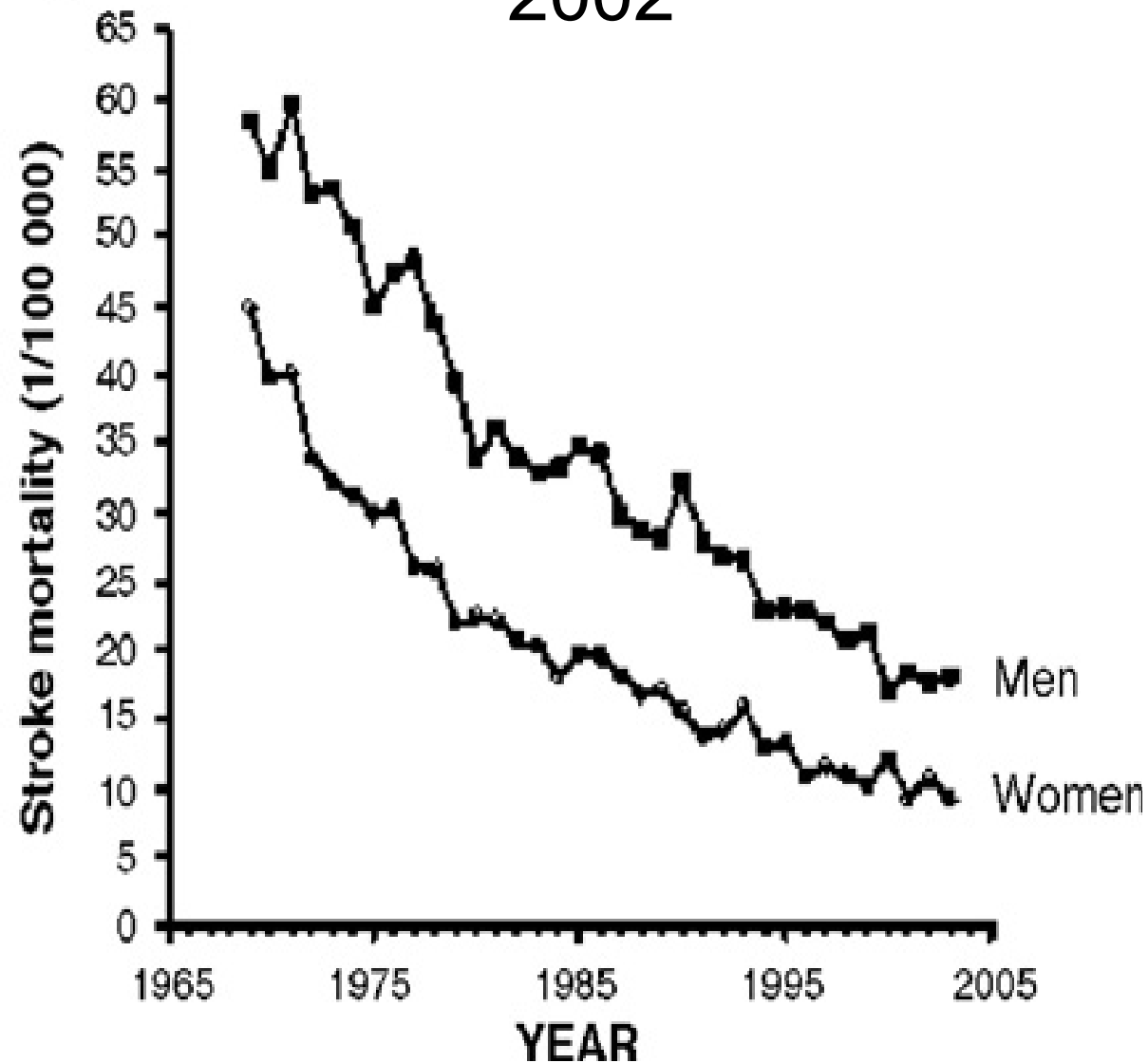
Karppanen H and Mervaala E. *Prog Cardio Dis* 2006;  
49:59-75

# Changes in Diastolic Blood Pressure in Finland, 1972-2002



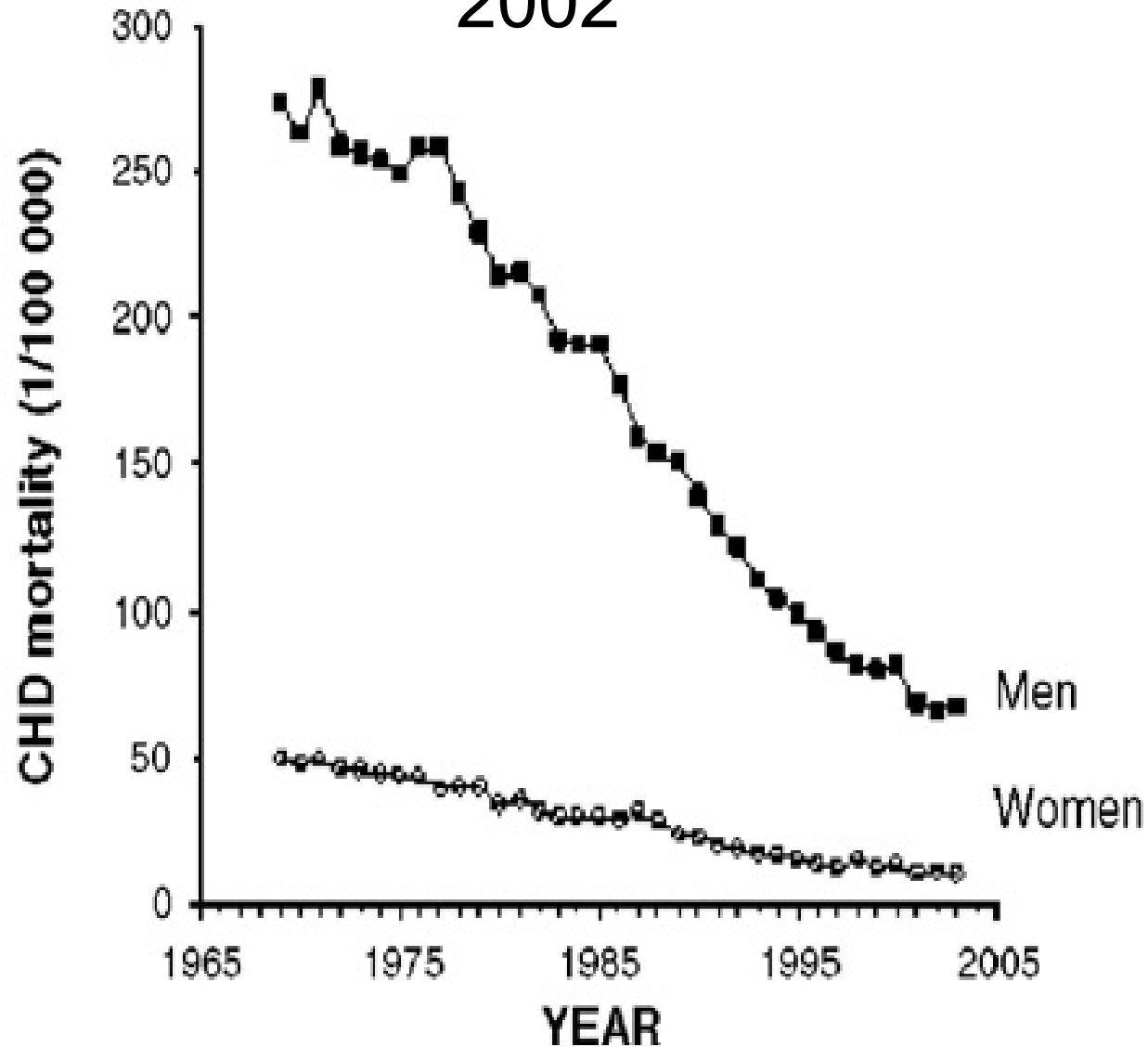
Karpannen H and Mervaala E. *Prog Cardiovasc Dis* 2006; 49:59-75

# Changes in Mortality from Stroke in Finland, 1968-2002



Karpanen H and Mervaala E. *Prog Cardio Dis* 2006;  
40:50-75

# Changes in Mortality from CHD in Finland, 1968-2002



Karppanen H and Mervaala E. *Prog Cardiovasc Dis* 2006; 49:59-75.